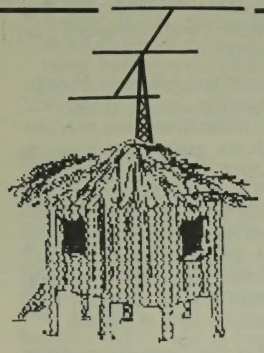
# Digital Digest

Vol. 2 No. 2 **Devoted entirely to Digital Amateur Radio Communications** Mar/Apr 1989

***In This Issue:***



***There's all this, and a whole lot more in this issue!***



## From The Publisher's Shack

It's hard to believe that Spring is just around the corner. Of course, the normal association 2ith Spring is "clean-up." This being the case... I'd like to issue the challenge, and the opportunity to all of our readers to dust off those keyboards, plug in your word processing software and write to us.

We, our staff columnists and I, would like to hear from you. We want to know more about what information you would like to receive in future issues of the Digest. Also, we would like to publish articles from you based on your digital operating experiences within the scope of this publication. Modes, software, computers, interfaces, rigs, etc. Anything that you have to share which will help expand our knowledge and enjoyment of this exciting area of our hobby.

Although it probably won't put you into early retirement, we do pay for published guest articles at the rate of $1.25 per column inch (approx. $35.00 per page). It might give you a little extra spending money to put back into your hobby if nothing else.

Communications is our hobby, and as I've said before and will say again, "the better, and more we communicate, the better will be our hobby and this publication." In regards to the latter, to make communicating with Digital Digest easier, we have now added a FAX terminal to our office facility. You may now fax material to us at (407) 671-0194. We can also download from CompuServe. On CompuServe, send E-mail to me, Subject: Digital Digest, I.D. '73330,1335. Of course, there is always surface mail courtesy of the U.S. Postal Service to the address found elsewhere in this publication.

Speaking of CompuServe, I would like to give a special thanks to Scott Loftesness, W3VS (HamNet Sysop) for the nice article he wrote about the Digest and published in a recent TAPR Newsletter. HamNet, in case you're not aware, is a great way to get information and meet your fellow digital ham friends via telephone modem.

In closing, we hope you are enjoying the Digest and look forward to your comments, suggestions and articles.

73's and hope to see you on the air soon.

Tom Arvo, WA8DXD
Publisher

### *Canada To Eliminate CW Subbands?...*

On February 18th, the Canadian Department of Communications (DOC) dropped another deregulations "bomb shell" on their amateur community! The DOC is to Canada... what the FCC is to the United States. (And it is the DOC, rather than Communications Canada... a name they had to drop when it was determined that name was already in use.) The proposal was not totally unexpected, however, since both of Canada's ham organizations, the CRRL (Canadian Radio Relay League) and CARF (Canadian Amateur Radio Federation), had come out in 1987 as favoring some sort of mode subband deregulation.

At present, Canada... like the United States, allows certain classes of amateurs to use particular types of emissions on specified portions of the ham bands. Parts of each band, especially the HF bands, are allocated to CW/digital... while analog emissions such as voice, television, facsimile must operate on another portion of that same band. The rationale generally given is that digital and analog emissions are not generally compatible.

In Canada, the frequencies 3.500-3.725 Mhz, 7.0007.150, 10.10010.150, 14.000-14.100, 21.00021.100, 28.000-28.100, 50.000-50.050 and 144.000-144.100 Mhz are reserved for CW/digital emissions.

The DOC is now proposing to totally eliminate the restrictions on the types of emissions that its amateurs may use within the radio frequency bands allocated to the (Canadian) Amateur Radio Service. In its place, the new regulations will specify a maximum authorized bandwidth, regardless of the emission. "Such an elimination," the DOC wrote in their proposal, "permits the Canadian amateur to enjoy equal privileges on a par with other radio users in the international radio environment... and particularly with those privileges currently extended to U.S. radio amateurs."

Thus, if the DOC has their way, Canadian amateurs will be allowed to operate any mode on any frequency from within an authorized amateur band, limited only by a maximum bandwidth specification. The DOC says the proposal will allow Canadian amateurs to:
(1.) experiment with new protocols and new emissions without having to request special permission or amend existing DOC regulations and;
(2.) will address the need for more phone frequencies, expressed by many Canadian amateurs after the last round of U.S. phone band expansions.

The Canadian DOC said it was also their opinion that amateurs are best able to decide what frequencies are most appropriate for their various activities. They are counting on the amateurs' "enviable record for selfpolicing" to ensure the success of the proposed deregulation. Canada also proposed to allow visiting (foreign) amateurs operating under a reciprocal license to operate with the same frequencies and emissions as Canadian amateurs.

This is a significant change. Foreign amateurs operating under reciprocal permits in the United States may only use privileges that are available to them in their own country! (See Part 97.311(b)3) If the proposal is adoptedand most Canadians feel it will be - U.S. amateurs visiting Canada will be able to operate in the voice mode on what was once CW spectrum. The United States has a bilateral agreement which makes American ham tickets automatically valid in Canada.

This means that the CW/digital portions at the beginning of the various ham bands will not be observed in Canada. American amateurs using digital modes, such as telegraphy, RTTY, packet, AMTOR... might encounter substantial Canadian voice mode competition. It also means that the CW/digital only 30 meter (10.100-10.150 Mhz) ham band could now be used for phone transmissions in Canada - something that was recently denied in the U.S.

This is a major change of policy for Canada and seems to underscore their intent of not supporting telegraphy-only spectrum when most of their amateurs wish additional phone spectrum... or that provisions be made for modern technology. So-called "gentleman's agreements" and "accepted band plans" will thus take on renewed importance in Canada.

As envisioned by the DOC, the maximum allowable bandwidths are as follows: 1.829.7 Mhz, 6 Khz; 50-148 Mhz, 30 Khz; 220-1300 Mhz, 6 Mhz... with the authorized bandwidths in the remaining microwave ham bands "not specified." A very short (only 30 days) comment period was permitted - until March 18th.

A somewhat similar proposal was suggested for the United States many years ago, but was never adopted. The FCC issued a Notice of Proposed Rule Making (Docket '20777, April 26, 1976) proposing to refer to authorized bandwidths rather than types of emissions. The FCC's version differed, however, in that it retained the subband approach and merely replaced specific emissions with maximum bandwidths.

*- Source: W5IY Report -*

### APPLE II Software Available...

APR is a packet-radio terminal emulation program for the APPLE II series of computers that features the WA7MBL YAPP binary file transfer protocol. Recently, a new version of APR (Version 1.2) was released and, besides fixing some problems that were present in the previous version, the following features were added.

- Terminal emulation with split-screen
- Text file uploading
- Session logging
- Ability to connect a printer
- State of options display
- Ability to change baud rate from within the program
- YAPP uploading and downloading for 8-bit file transfers
- TNC-220 and KPC-2 support
- 40 or 80 column screen control
- Apple II', Apple //e, Apple //c and Apple IIgs support
- SSC, Apple IIgs modem port and Apple //c modem port support
- VIDEX 80 support for Apple II' users

APR can be obtained by surface mail on a 5-1/2" disk for $5.00 or 3-1/2" disk for $6.00 in Apple ProDOS or MS-DOS format (containing both the Italian and the English version) from:
Paolo Viviani, I1VVP (@ I1YLM)
C.So Brunelleschi 36 I-10141 Torino, Italy
Please indicate the desired version (Apple ProDOS or MS-DOS).

*-Source: Gateway-*

### AMSAT MICROSAT's Go Commercial...

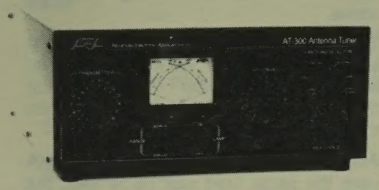
AMSAT-NA President Douglas A. Loughmiller, KO5I, has announced that AMSAT-NA and interferometrics, Inc. of Vienna, Virginia, have established an exclusive working agreement for the commercial use outside the Amateur Radio Services of certain technology pertaining to the MICROSAT concept.

AMSAT is currently using this technology to construct four amateur MICROSAT's for 1989 launch and will assist Interferometrics in its use. Under the agreement, Interferometrics will use its best efforts to market and produce MICROSAT's for non-Amateur Radio applications... and will pay AMSAT-NA a fee based upon the revenue it receives from this program. These fees will be used by AMSAT for amateur satellite construction and related technical projects. Principal responsibility for implementing this agreement rests with Jan King, W3GEY, VP of Engineering.

*-Source: W5YI Report -*

### Advanced Electronics Applications, Inc. (AEA)...

has begun shipping their new AT-300 Antenna Tuner. The AT-300 is the first model in a line of anyenna tuners to offer AEA-quality at an affordable price.



The AT-300 Antenna Tuner features:

- Low-pass design to reduce or eliminate TVI
- Frequency range coverage of 3.5 MHz to 30 MHz
- Capacity is 300 watts continuous power
- Dual-needle watt meter gives direct reading of forward power, reflected power and SWR
- Meter range selects 300 watt and 30 watt to ease tuning.
- Two, 18-tap inductors give improved tuning accuracy
- Front panel controls include impedance adjustment, antenna switching, meter power level switching and meter lamp switching.
- Rear panel connections include a coax connector for transmitter input, two coax connectors to antennas, one coax connector to a dummy load, two ceramic feed-thru connectors to balanced feedlines, one ceramic connector serves single-wire antennas and a dc power connector to the meter lamp. For more information contact:

AEA, P.O. Box C2160, Lynnwood, WA 98036 / Phone (206)775-7373

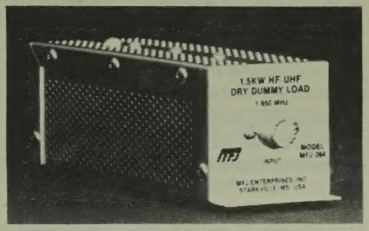
### Rose Switch On . . .

The ROSE (RATS Open Systems Environment) X.25 Packet Switch software has been released by The Radio Amateur Telecommunications Societ (RATS). This release operates with IBM (or clones) or PacComm DR-200 two-port controller. The software was written by Tom Moulton, W2VY, and is free for amateur use only. It may be obtained by downloading it from CompuServe's HamNet (filename: ROSESW.ARC)

*From J. Gordon Beattie, Jr., N2DSY via CompuServe's HamNet*

### MFJ Enterprises, Inc. ...

announces the release of their new 1.5 Kw UHF/VHF/HF "Dry" dummy load.




This new dummy load, an MFJ first - lets you tune up to 650 MHz and get extremely low SWR. It handles 100 watts for 10 minutes, 1500 watts for 10 seconds. The voltage gradient is 10 Kv/inch.

SWR is extremely low: 1.1:1 at 30 MHz, below 1.3:1 to 650 MHz. MFJ-264 is usable to 750 MHz. It measures 3x4x7 inches and comes with MFJ's one year unconditional guarantee... price is $109.95.

For more information, contact any MFJ dealer or MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 35762. Phone (601) 323-5869

by Lynn W. Taylor, WB6UUT
463 Myrtle Street • Laguna Beach, CA 92651

# ★ The Birth Of Packet Radio ★

In this issue we start our discussion of protocols. My goal here is twofold: to show how various protocols work so we can understand how Radio-based Packet-switched Networks operate, and to perhaps start some thinking about what we can do after AX.25.

Packet Radio did not start with Amateurs. In fact, Packet Radio was around 10 years before U.S. Amateurs were granted wide enough digital privileges to run Packet. Instead, It started around 1970 with a major university and a problem.

The University of Hawaii has seven campuses spread across four islands in the middle of the Pacific.

The traditional solution to the problem of providing computing services to these campuses (remember, Microcomputers didn't appear until 1975) is to go to the local Telephone Company and contract for a wire between the sites (expensive when you have to cross several miles of ocean, and often unreliable) or provide separate computing facilities at each campus (also expensive back when computing meant large facilities and lots of expensive equipment).

Their solution was to apply some of the lessons from ARPANET (the first wire-based packet network) to a new environment, radio, creating the ALOHA network.

Inbound traffic from the various sites was transmitted on 407.350 MHz, while outbound traffic from the main computing center was transmitted on 413.475 MHz with enough power to go about 20 miles.

The Aloha protocol is simple. First comes a 32 bit header containing, among other things, the station address and the packet length, followed by a 16 bit checksum, then up to 80 bytes of data, followed by another checksum. At 9600 baud, this took 73 milliseconds to transmit.

When the data is correctly received, an acknowledgement is sent by the receiving station (or "Menehune" another term for TNC is IMP, Menehune is Hawaiian for imp).

ALOHA comes in several versions which differ in how channel access and timing are handled.

The first, often called "pure" Aloha used the simplest scheme of all. If one of the Menehune had traffic, it transmitted.Of course, if two had traffic there was probably a collision, and they had to try again. Various schemes were tried for the retry interval, delays from 0.2 seconds to 1.5 seconds, various patterns, etc. to minimize the impact of the collisions.

One solution would have been carrier detection: everyone listen first, then transmit if the channel is clear. To us, this would be the most obvious way to deal with the problem, and is in fact built into modern Amateur Radio TNCs.

That wasn't a simple option for ALOHA: remember that each site has a receiver on one frequency, and a transmitter on another. Switching the receiver frequency long enough to check for a clear channel might cause the outlying Menehune to miss something from the central site (the central Menehune didn't have to worry about it because it was the only station transmitting on the "outbound" channel), while two receivers at each site would increase the cost of the Menehune.

Other, lower cost methods were devised and tested, the first being Slotted ALOHA.

Since the Menehune transmit to the central site at essentially random intervals, one packet from any given site can clobber two packets which would have ordinarily arrived undamaged. One would get damaged at the beginning, and the other at the end.

Slotted ALOHA combatted this by providing a synchronized signal to all of the outlying sites, with each transmitting at a certain time (or slot).

Since a collision would now do less damage, throughput went up from about 18% of the theoretical maximum, to 36% of the theoretical maximum, or from an effective rate of about 1800 baud, to an effective rate of 3600 baud.

Slotted ALOHA helped, but other schemes to increase throughput were also tried:

Controlled ALOHA watches the number of retries on each packet to get a crude idea of network loading: as the retries increase, each Menehune becomes more "reluctant" to transmit. Since fewer and fewer stations are likely to transmit during each slot, collisions go down and data still moves to the main campus from the remote sites.

Reservation ALOHA came along about 1975. In this scheme, a group of slots were grouped into a frame, with each active remote site assigned a single slot within that frame. If the owner does not transmit during his slot, it becomes available for other stations during the next frame.

To reclaim his slot, the owner simply transmits his traffic in his normal slot. If a collision occurs, only the rightful owner may transmit in that slot during the next frame.

This method of course requires that the size of the frame (i.e. the number of slots) be equal to the number of users, and that the number of users be known - not often the case in Amateur Radio networks.

Another variation of Reservation ALOHA uses the same fixed size frame idea, but whenever a station successfully occupies a slot in the frame, that station is entitled to the same slot in the next frame.

Since fewer slots are wasted (either due to collision, or simply left idle) more stations can use this system, and it can operate more efficiently.

Still another Reservation ALOHA scheme divides one of the slots into "sub-slots" which can be used to reserve space in the next frame. Short "reservation packets" are sent in the subslots, and, if successful, the appropriate slot will belong to the reserving station in the next frame.

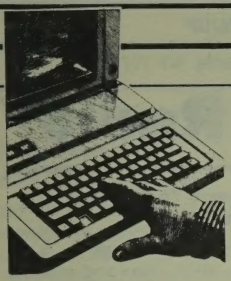
Obviously, there are differences between ALOHA and the existing Amateur network: ALOHA covered a well defined geographical area, with transmitters and receivers matched to the network, and with one entity controlling all of the Menehune. Amateur networks consist of a wide variety of stations, each under control of an individual who (ideally) will balance his need for network time against the overall network throughput, and with power levels varying from 1 watt handhelds to stations with over a kilowatt ERP.

Next issue, we will continue our Protocol discussion with a look at the Open Systems Interconnect model and the services offered at each layer, followed in subsequent issues by the specifics of AX.25 and a look at the future of Amateur Packet Radio. If you have any comments, or would like to share your view of the future, please let me know. I can be reached by writing to the address at the top of this column, or through CompuServe at 74176,52.

***** *Please Note* *****

*If you have news and information of interest to the digital amateur community, please let us know!*

*— Editor —*



The following Turbo Prolog Code tests the letters of a callsign, just the same as illustrated in the last issue. The difference is that before we were testing a string a character at a time. Here, we reduce the string to prolog "list" of characters by using the predicate split_call. Then we pass the list to the test_call( ) predicate which is defined to accept a list in lieu of a string.

*This is a complete program and may be typed and run.*

```
% ============================================================================
% Test_cal.pro //ac4x// Callsign Test Example Program for Turbo Prolog
% ============================================================================

domains
        clist = char*       % clist is a list of characters
database
        % no items used here
predicates
                split_call(string,clist)
                test_call(clist)
                ltr(char)
                no(char)
   nondeterm    run

clauses
        run:-   write("\ncallsign to test: "),readln(C),
                upper_lower(Call,C),              % make it upper case
                frontToken(Call,PureCall,_),      % remove_ssid - if any
                split_call(PureCall,List),        % make list of chars
                write(List),nl,                   % shows the list created
                test_call(List),                  % is it ok?
                write("\nLOOKS OK TO ME\n"),run.
        run:-   write("\nINVALID CALLSIGN\n"),run.

        split_call(Call,[CH|T]):-
                frontchar(Call,CH,Rest),!,
                split_call(Rest,T).
        split_call(_,[]).

        test_call([C1|[C2|[C3|_]]]):-
                ltr(C1),ltr(C2),no(C3),!;
                ltr(C1),no(C2),ltr(C3),!;
                no(C1),ltr(C2),no(C3),!;
                ltr(C1),no(C2),no(C3),!.

        ltr(CH):-CH>=('\58'),CH<=('\90').      % capital letter
        no(CH):- CH>=('\48'),CH<=('\57').      % number

GOAL run.
```

The items C1 C2 and C3 are the first characters of the list and all others are ignored. The predicates ltr() and no() are the same as presented last issue. You could easily test more characters and can test the length of the total string.

Since prolog is a pass-fail test and backtracks upon failure, you can see that if any combination passes, then test_call() is successful. For easier reading, you may substitute "if" for ":-", "or" for ";" and "and" for ",". The "!" is the cut character and simply stated say's don't backtrack, if you get this far.

One interesting thing about the Turbo Prolog built-in predicate "fronttoken" is that on a callsign/ssid combination it produces a very useful list. As an example, the call "AC4X-3" is reduced to a 3 item list ... ["AC4X"]["-"]["3"]. That makes it easy to strip and/or use the SSID. For mail, in the MPC BBS system, I use a predicate named "pure_call" which simply takes the fronttoken of any callsign thus stripping the SSID.

*Editors Note: If you have questions regarding this program please contact* ***Lacy McCall, AC4X,***
*3001 Zelda Drive, Montgomery, AL 36106*

Digital Digest

PACKET

by Norman Sternberg, W2JUP

279 Adirondack Drive • Farmingville, NY 11738

# "Deviant Behavior In Digital Radio"

## or... "How I Learned To Love My Modulation Index"

I'm sure you've heard it. "It's easy to get on packet radio with your VHF/UHF rig, even with your HT. All you have to do is connect the AFSK output of your TNC into the mike jack on your FM rig.

"Voila! Instant Digital Radio! So how come some people can't make it work as advertised?

From what I've seen since RTTY was first authorized for radio amateurs some 35 years ago, the single most frequent cause of failure or poor results in tone-keyed digital FM radio is the transmitting station's deviation or modulation index. This is true for Baudot and ASCII RTTY and especially devastating in packet radio.

Since I got started in packet radio, my notes show that at least 50% of all the "How come I can't connect" problems have been the direct result of excessive deviation by the sending station, or by excessive deviation at a node or link through which that user was trying to communicate. A secondary cause appears to be off-frequency operation combined with high modulation indices. It looks like an awful lot of people have gotten into digital FM radio and taken the RADIO part for granted.

**RULE ONE: Know The Basics**

There are no secrets, no special tricks, no mystical alchemist's rites in this stuff. Most of it involves common sense and knowing the basics of the angle modulation schemes used in our "FM" radios.

Some folks succeed on packet radio. Others can't seem to "make it work right" and die a slow, agonizing death from a disease called "Massive Timeouts of the Radio Link".

Here are some easy-to-understand ideas about "digital" communication using FM radios. These insights were originally gained ago while experimenting with my first RTTY-only FM repeater (W2JUP/R, Hempstead, 1969, later WR2AFC), and from some 20 years as chief engineer at FM broadcasting stations.

**RULE TWO: Numbers Don't Lie**

Let's think about your FM transmitter's modulation indices and deviation and the audio tones used in VHF/UHF packet operation at 1200 BPS. The information presented here is derived from some simple applications of a mathematical concept called a Bessel Function, and something called Carson's Rule, which we'll use further on.

DON'T PANIC! You don't have to rush over to your local community college to sign up for Spherical Trigonometry 101. If you've gotten yourself though high school and managed to get a ham ticket, you will understand this stuff if you want too.

**RULE THREE: Bessel Is Beautiful**

In 1817, a German astronomer and mathematician named Friedrich Wilhelm Bessel introduced a mathematical function to study planetary and orbital disturbances. By happy coincidence, Bessel Functions also describe the performance of angle modulation systems (FM and PM). Bessel Functions demonstrate that in any angle modulation system (the stuff we use on VHF/UHF packet), the audio signals used to modulate the carrier cause the following things to happen - in the simplest terms:

1. When no modulation is applied, all the RF energy is in the carrier signal.
2. The amplitude of the carrier starts to decrease as you apply modulation.
3. The energy removed from the carrier is distributed symmetrically in the sidebands.
4. As modulation is increased further, the carrier amplitude eventually reaches ZERO - this is called a "carrier null".
5. When the carrier energy reaches ZERO, all the modulation is distributed symmetrically in multiple sidebands.
6. As the modulation is further increased, the carrier reappears and starts to increase in amplitude again.
7. As the carrier increases again in amplitude, the energy in the first pair of symmetrical sidebands starts to decrease.
8. As this process is continued, the carrier will again reach maximum and decrease once again to ZERO - this is called a "second carrier null". At the same time, the energy in the sidebands will vary, with some sidebands increasing, some decreasing.
9. When the modulation index reaches a value of 2.4 radians, the carrier DISAPPEARS COMPLETELY - for the first time.

Here are some key values to remember:

a) The first Bessel (carrier) null occurs at a modulation index of 2.4 radians.

b) The second Bessel (carrier) null occurs at a modulation index of 5.5 radians.

**RULE FOUR: Learn To Play The Numbers Game**

"Modulation index"? "Radians"?
*"What's a modulation index and what's a radian?"*

If you operate FM voice repeaters, you're used to hearing the word "deviation". You're probably not familiar with terms like "modulation index" and "radians". It's really quite simple. We use "radians" because we're dealing with "angle" modulation systems. "Modulation index" tells us much more about what's happening than the overworked term, "deviation".

"Modulation index" expresses two things at the same time:

1. Deviation - how far the carrier "swings" in each direction
2. Modulating frequency - what audio is being used to modulate the carrier The general formula is:

*MI = Delta-F / Fm*
*Modulation Index =*
*Peak Deviation / Modulating Frequency*

or, looking at things in the "opposite direction",

*Delta-F = MI x Fm*

*Peak Deviation =*
*Modulation Index x Modulating Frequency*

These simple arithmetical relationships (!) show us what happens when we use a constant audio tone to frequency modulate a carrier.

Let's use our simple arithmetic to look at the modulation indices we'll get when we "angle" modulate a carrier at the mark and space tones we use in VHF/UHF packet operation:

| DEVIATION in KHz | MODULATION INDEX Radians @ 1200 Hz | MODULATION INDEX Radians @ 2200 Hz |
|---|---|---|
| 1.5 | 1.25 | 0.68 |
| 2.0 | 1.67 | 0.91 |
| 2.5 | 2.08 | 1.14 |
| 3.0 | 2.5 | 1.36 |
| 3.5 | 2.9 | 1.59 |
| 4.0 | 3.3 | 1.81 |
| 4.5 | 3.75 | 2.05 |
| 5.0 | 4.17 | 2.27 |
| 5.5 | 4.58 | 2.5 |

**RULE FIVE: Carry On With Carson's Rule**

Back in 1929, a gentleman named Carson published some ideas about angle modulation systems in an issue of the Bell Laboratories Journal.

Carson gave us more nifty insights into what happens when we use tones to "angle-modulate" an RF carrier. Carson's Rule shows how packet tone modulation requires MORE bandwidth than you might expect.

*(cont'd next page)*

*(cont'd from previous page)*

More arithmetic:

*Bif = 2(D x 2Fm) where:*

*Bif = IF Bandwidth in KHz needed to pass significant sidebands,*
*D = Peak Deviation in KHz*
*Fm = Highest frequency component of the modulating tone;* For example, if a 2.2 KHz tone is transmitted at 5 KHz deviation, the IF bandwidth needed to pass significant sidebands is: *Bif = 2(D x 2Fm) or*
*2 x [5.0 (2 x 2.2)] = 18.8 KHz*

You might want to look at the I.F. bandwidth specs in the manual that came with your VHF/UHF FM transceivers. In general, the better the receiver, the narrower the I.F. passband. Many popular rigs have an I.F. passband of 15 KHz at the 6 dB points. Some of the "tighter" multimode rigs are specified at 11 to 12 KHz at the 6 dB points.

Think about what's happening when you try to push a tone-modulated FM signal whose width is almost 19 KHz through an I.F. system that is only 12to15 KHz wide?

**RULE SIX: Little Knowledge Is A Dangerous Thing**

Is it possible that only a few truly expert people in packet radio, RTTY (and other computer-based systems) know much about radio? Is it possible that many "computerists" have not gone beyond the minimum learning or memorization needed to get their original licenses?

With some noteable (but rare) exceptions, the packet and RTTY gurus don't even think about the RADIO that's going to carry the output of their magical protocols. That's not where their guru skills lie; they leave the radio part to the users of their magical protocols and digital communications methods.

This all hits the fan when the poor digital user who generally doesn't have a spot of trouble working his or her local FM VOICE repeater - gets a shiny new packet box.

Mr. or Ms. NewUser eagerly stuffs the output of that nifty new TNC or multimode controller into the mike jack of a trusty two-meter HT or FM base station or mobile radio, and goes merrily on his or her digital way assuming (often wrongly) that all is going to be just dandy.

Few newcomers (and an unfortunately large number of older packeteers) give thirty seconds thought to the MODULATION INDEX or DEVIATION of the resultant radio signal. The problem is compounded by dubious or erronious setup instructions in some manufacturer's product manuals.

If you follow some of their instructions to the letter, you may well earn a place in The Fellowship of Failure. Some of the published instructions (and too often the advice received from other newcomers) are almost guaranteed to contribute to a higher probability of failure.

The problem will often depend on the characteristics of the radio at the receiving end. with different receiving radios. In general, the better the FM receiver, the "tighter" that receiver's IFs, the worse the problem is liable to be.

As I said, there's no magic, mysticism or exotic wizardry in this modulation stuff. You just have to go "back to the basics".

Chapter 9 of the 1988 ARRL Handbook, pages 9-5 thru 97, and 9-10 thru 9-13, present an excellent exposition of everything any ham could possibly want to know about the subject as far as this mode is concerned. The simplest way to understand this is to look again at Carson's Rule.

**RULE SEVEN: Digital Frequency Displays Can Be Liars**

Modern radios with digital frequency readouts can lie! The accuracy of your transmit and receive frequencies usually depends on a circuit inside your radio called a "reference oscillator". The act-value on the readout is not usually any indication of "where" your reference oscillator is really operating. Too many people assume that because their synthesized radio's display says they're on a specific frequency, that's the frequency they're on. True, only if their radio's "reference oscillator" is on frequency. Many times this is just NOT the case. Reference oscillators are known to drift off frequency, especially in HTs and mobile rigs that have been bouncing around on the local freeway for months or years. You can be as much as THREE KHz off the displayed frequency and never know it! Your buddies on the local FM voice repeater may comment that your signal "sounds kinda fuzzy", but you'll usually get through that voice repeater and communicate more or less successfully. BUT bring that same frequency error into the digital radio world and you may be in deep distress!

A heavily-deviated signal from an off-frequency transmitter is almost guaranteed to result in asymetrical distortion of the post-detected or received audio, and failure to decode ALL the received NRZI ASCII data.

I examine dozens of "problem signals" every year, and in addition to grossly excessive deviation, I see carriers as much as 3 KHz off the nominal channel center. Combine that frequency error with a 5 KHz (or higher) deviation level and you have instant headache.

**RULE EIGHT: Don't Dance The "Digital Twist"**

This whole picture becomes even more complicated by the instantaneous modulation limiting and preemphasis circuits found in so many amateur VHF/UHF FM radios. Most of these radios boost the level of the high tone from 4 to 6 dB. Many of these deviation limiting circuits - the way they're set when they leave the factory tend to reduce the amplitude of the HIGH tone before they touch the low tone. This produces the "twist" effect so commonly seen, in which the received SPACE (2200 Hz) tone is 4, 6, 10 or even 12 dB lower in amplitude than the MARK (1200 Hz) tone.

The majority of digipeaters and NET/ROM or THENET nodes on the air in this area use the TNC2 or some commercial clone like the AEA PK-80, or MFJ-1270 or PacComm TINY2. Those TAPR-licensed designs use the Exar 2211 PLL Decoder chip as the tone demodulator. This is NOT an inherently bad choice, but Exar's Engineering Design and Applications Notes clearly state that the post-detected audio supplied to the decoder chip should not have more than four (4) dB difference between high and low tones, and that if greater amplitude differences exist, the result will probably be significant transition decoding errors and increased probability of high bit error rates.

All this "techytalk" and guru-level gobbledegook begins to come into focus when you remember that our present packet protocols do a cyclic redundancy check on the whole packet frame from the first byte. If only ONE BIT of any one byte is wrong, then the CRC fails and the entire packet is thrown in the Bit Bucket - GO DIRECTLY TO "Retry City"!

Consider the packets you're sending. Let's assume that you're typing without any carriage returns; this means that you're letting your TNC sending the whole frame based on the PACLEN parameter value, which we'll assume are still at the default value of 128. That's 128 BYTES of your "user data", which now gets combined and packetized with the protocol's own overhead, usually 20 additional bytes minimum. When you add up all your eight-bit bytes, your transmitted frame comes to about 1184 BITS. If even ONE BIT in that total bit stream is "trashed" or corrupted for any reason, then that whole packet frame is thrown away RETURN TO "Retry City"!

*(Cont'd page 17)*

by Paul Newland, AD7I
Post Office Box 205 • Holmdel, NJ 07733-0205

# Aplink Update ★ Navtex Operation

## APLINK STATUS UPDATE

In the first article of Digital Digest I described the APLink BBS system. I would like to take a few lines here to provide you with an update. Recall that APLink is a BBS software system that runs on IBM PCs (or clones) and provides dual port operation: one on AMTOR HF and another on VHF/UHF packet. The neat thing with APLink is that a mobile station (or any station without access to VHF Packet) can check in via HF on the AMTOR port and send/receive messages to people via packet. And those packet messages can be forwarded most anywhere in North America by the regular packet network. That means that someone on a boat in the Pacific Ocean can leave a message on a west coast APLink system addressed to someone on packet located on the east coast of the U.S. Pretty neat, if you don't have access to VHF packet, or if you move about quite a bit. That AMTOR HF port allows mobile people (be it in a motor home or pleasure boat) to still have access to VHF packet forwarding.

Aplink software continues to find its way onto new HF BBS systems at the rate of about one per month. Current known systems are listed in Table 1.

If you are interested in establishing an HF BBS you might want to consider using APLink software. The software is available at no charge from me (please enclose a formatted 5-1/4 inch diskette with an SASE) or on LIB 9 of CompuServe's HAMNET.

Here's the list of known APLink stations as of February 16, 1989 as listed on the WA8DRZ system. All frequencies are MARK tone RF frequency, in kHz. The SPACE frequency is 170 Hz lower than the MARK frequency.

| Call / (Selcal) | Frequency(s) | Operator | Station Location |
|---|---|---|---|
| AH6D (AAHD) | 14073.5 | Paul | (Honolulu), Hawaii |
| G4SCA (GSCA) | 14070.0 | John | Plymouth, England |
| | (1800-2200z Temporary) | | |
| HL9TG (HLTG) | 14073.5 | Gary | Camp Humphreys, Korea |
| KB1PJ/8 (KBPJ) | 14070.5 | David | Cleveland, Ohio |
| KS5V (KKSV) | 14072.5 | Ed | San Antonio, Texas |
| PJ2MI (PJMI) | 14077.8 | Jose | Curacao, Netherlands |
| | (14079.9 AFSK) | | |
| TI2ALG (TALG) | 14074.0 | Alvaro | San Jose, Costa Rica |
| | (Temp QRG, May QSY) | | |
| VK2AGE (VAGE) | 7045.0 / 14075.0 | Gordon | Lismore, NSW, Australia |
| | 14077.0 / 21076.0 | | |
| VK2EHQ (VEHQ) | 14077.0 | Peter | Sydney, NSW, Australia |
| WA8DRZ/6 (WDRZ) | 14072.5 / 14073.5 | Craig | (San Francisco, CA) |
| | 14074.5 / 14075.5 | | |
| WB7QWG/9 (WQWG) | 14071.5 | Bob | Indianapolis, Indiana |

## NAVTEX

There are some ideas in this world that are so simple, yet so effective, that when you first hear about them you might think: "so what, that's almost obvious." I guess NAVTEX might fall into that category. NAVTEX(1)(2) is a radio teleprinter system that broadcasts messages to ships in coastal areas telling them of current weather, changes in aids to navigation, and other information needed to provide safe operation of vessels. There are many stations throughout the world and almost all operate on 518 kHz (that's right, 518 kHz; just below the standard AM broadcast band) using standard AMTOR/SITOR FEC format with 170 Hz frequency shift. You don't need a NAVTEX decoder to print these messages. You only need a NAVTEX decoder if you want to avoid printing redundant copies of the same message during subsequent broadcasts.

In the United States, the U.S. Coast Guard is responsible for NAVTEX broadcasts. They have operational stations near Boston MA, Norfolk VA, Miami FL, San Juan PR and New Orleans LA. Times of transmission are shown in Table 2. West coast NAVTEX broadcasts are scheduled for Long Beach, San Francisco and Astoria but they probably won't be online before 1990.

Each station runs about 1 to 3 kW into either a 75 foot wire/whip or taller tower. Coverage over the land mass of the eastern U.S. isn't particularly strong but the coastal areas from Maine to Texas to 100 nautical miles offshore should provide good copy 90% of the time. From my location on the central coast of New Jersey during the day I can hear Portsmouth pretty good and Boston just above the noise. During the night, when all the lamp dimmers in the neighborhood are off and propagation at 518 KHz really is zinging, I can pick up all the stations listed below.

| UTC | EST | EDT | Call | Location |
|---|---|---|---|---|
| 0000 | 7:00 PM | 8:00 PM | NMA | Miami |
| 0130 | 8:30 PM | 9:30 PM | NMN | Portsmouth |
| 0300 | 10:00 PM | 11:00 PM | NMG | New Orleans |
| 0415 | 11:15 PM | 12:15 AM | NMR | San Juan |
| 0445 | 11:45 PM | 12:45 AM | NMF | Boston |
| 0600 | 1:00 AM | 2:00 AM | NMA | Miami |
| 0730 | 2:30 AM | 3:30 AM | NMN | Portsmouth |
| 0900 | 4:00 AM | 5:00 AM | NMG | New Orleans |
| 1015 | 5:15 AM | 6:15 AM | NMR | San Juan |
| 1045 | 5:45 AM | 6:45 AM | NMF | Boston |
| 1200 | 7:00 AM | 8:00 AM | NMA | Miami |
| 1330 | 8:30 AM | 9:30 AM | NMN | Portsmouth |
| 1500 | 10:00 AM | 11:00 AM | NMG | New Orleans |
| 1615 | 11:15AM | 12:15 PM | NMR | San Juan |
| 1645 | 11:15 AM | 12:45 PM | NMF | Boston |
| 1800 | 1:00 PM | 2:00 PM | NMA | Miami |
| 1930 | 2:30 PM | 3:30PM | NMN | Portsmouth |
| 2100 | 4:00 PM | 5:00 PM | NMG | New Orleans |
| 2215 | 5:15 PM | 6:15 PM | NMR | San Juan |
| 2245 | 5:45 PM | 6:45 PM | NMF | Boston |

I am using a 30 inch antenna connected to a Burhans(3) broadband VLF/LF active antenna amplifier in my attic. The amplifier drives about 100 feet of RG58 coax that ends in a Burhans VLF converter which uses commutating mixer to hetrodyne the 518 kHz signal up to 4018 kHz so I can receive it on my ham band Drake R4C receiver. I don't usually give plugs to vendors but the Burhans equipment (which has been fully described in previous issues of the LOWDOWN -the journal of VLF radio experimentors) is inexpensive and top notch. Ralph Burhans spent years designing professional LF/VLF equipment on government contract; his stuff for the radio experimentor works very well.

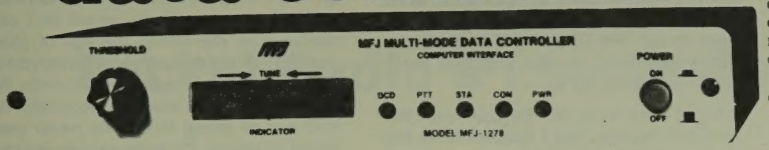
What I find most interesting about NAVTEX is that it includes a simple header to identify the message for the benefit of NAVTEX decoders. The header is a single line that precedes the message and is in the form of:

ZCZC abnn

Where ZCZC is a unique marker (i.e., the characters ZCZC shouldn't be used as part of any message text); the symbol "a" is a character of the set (A-Z) and represents the station of origin (not necessarily the station that actually transmits the message -although it often is); the symbol "b" is a character of the set (A-Z) and represents the type or category of message; and the two characters "nn" represent a two digit number of the set (00-99).

*(Cont'd page 18)*

# MFJ multi-mode data controller




## *9 modes* for only . . . $249.95

**Amateur** radio's most versatile multi-mode data controller -- the MFJ-1278 -- lets you join the fun on Packet, AMTOR, RTTY, ASCII, CW, Weather FAX, SSTV, Navtex and gives you a full featured Contest Memory Keyer mode . . . you get 9 modes . . . for an affordable $249.95.

**Plus** you get MFJ's new **Easy Mail**tm so you and your ham buddies can leave messages for each other 24 hours a day.

**You'll** find it **the most user friendly of all multi-modes.** It's menu driven for ease of use **and** command driven for speed.

**A** high resolution 20 LED tuning indicator lets you *tune in signals **fast** in any mode.* All you have to do is to center a single LED and *you're precisely tuned in to within 10 Hz* -- and it shows you which way to tune!

**Plus** you get 32K RAM, KISS for TCP/IP, high performance HF/VHF/CW modems, software selectable dual radio ports, AC power supply and more.

**All** you need to join the fun is an MFJ-1278, your rig and any computer with a serial port and terminal program.

**You** can use the MFJ Starter Pack to get on the air instantly. It includes computer interfacing cable, terminal software and friendly instructions . . . everything you need to get on the air fast. Order MFJ-1282 (disk)/MFJ-1283 (tape) for the C-64/128 and VIC-20; MFJ-1287 for Macintosh; MFJ-1284 for the IBM or compatible, $19.95 each.

### Packet

**MFJ's** new generation packet mode gives you genuine TAPR software and hardware plus many MFJ enhancements like Easy Mail™.

**A** new Kiss interface makes the MFJ-1278 TCP/IP compatible.

**Extensive** tests published in **Packet Radio Magazine** ("HF Modem Performance Comparisons")prove the TAPR designed modem in the MFJ-1278 gives better copy with proper DCD operation under all tested conditions than the other modems tested.

### *New* AMTOR mode!

**Now** the MFJ-1278 has a new AMTOR and Navtex mode, making it the only controller to feature **nine** digital modes.

**MFJ-1278** transmits and receives AMTOR and includes all AMTOR modes: ARQ (Mode A), FEC and MODE S (Mode B).

### Baudot RTTY

**You** can copy all shifts and all standard speeds including 170, 425 and 800 Hz shifts and speeds from 45 to 300 baud. *You can copy not only amateur RTTY but also press, weather and other exciting traffic.*

**You** can transmit both narrow and wide shifts. The wide shift is a standard 850 Hz shift with mark/space tones of 2125/2975 Hz. This lets you operate MARS and standard VHF FM RTTY.

### ASCII

**You** can transmit and receive 7 bit ASCII using the same shifts and speeds as in the RTTY mode.

### CW

**You** get a Super Morse Keyboard mode that lets you send and receive CW effortlessly, including all prosigns -- it's tailor-made for traffic handlers.

**A** huge type ahead buffer lets you send smooth CW even if you "hunt and peck".

**You** could store entire QSOs in the message memories, if you wanted to! You can link and repeat any messages for automatic CQs and beaconing. Memories also work in RTTY and ASCII modes.

***A** tone Modulated CW mode turns your VHF FM rig into a CW transceiver* for a new fun mode. It's perfect for transmitting code practice over VHF FM.

**An** AFSK CW mode lets you ID in CW.

**You** also get a random code generator that'll help you copy CW faster.

### Weather FAX

***You'll** be fascinated as you watch WEFAX signals blossom into full fledged weather maps on your Epson or IBM graphics compatible printer.

**Automatic** sync and stop lets you set it and leave it for no hassle printing.

**You** can save FAX pictures and WEFAX maps to disk if your terminal program lets you save ASCII files to disk.

**Pictures** and maps can be saved to disk or *printed to screen in real time or from disk if you have an IBM or Macintosh* with the MFJ Starter Pack.

**You** can transmit FAX pictures right off disk and have fun exchanging and collecting them.

### Slow Scan TV

**The** MFJ-1278 introduces you to the exciting world of slow scan TV.

**You** can print slow scan TV pictures on any IBM or Epson graphics compatible printer. If you have an IBM or Macintosh you can print to screen and save to disk with the MFJ Starter Pack.

**You** can transmit slow scan pictures right off disk. If your terminal program lets you save ASCII files you can save pictures from over-the-air QSOs.

**You** can transmit and receive 8.5, 12, 17, 24, and 36 second black and white format SSTV pictures using two levels.

### Contest Memory Keyer

***Nothing** beats the quick response of a memory keyer during a heated contest.*

**You'll** score valuable contest points by completing QSOs so fast you'll leave your competition behind. And you can snag rare DX by slipping in so quickly you'll catch everyone by surprise.

**Message** memories let you store contest call, name, QTH, rig info -- everything you used to repeat over and over.

**You** get iambic operation, automatic incrementing serial numbering, weight control to penetrate QRM and more.

### More Features

**Turn** on your MFJ-1278 and it sets itself to match your computer baud rate. Select your operating mode and the correct modem is automatically selected.

***Plus . . .*** printing in all modes, threshold control for varying band conditions, tune-up command, lithium battery backup, RS-232 and TTL level serial ports, watch dog timer, FSK and AFSK outputs, output level control, speaker jack, key paddle jack, test and calibration software, Z-80 at 4.9 MHz, 32K EPROM, and socketed ICs. FCC approved. 9x1½x9½ in. 12 VDC or 110 VAC.

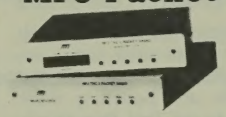
Get yours today and join the fun crowd!

### *New* Firmware Update

**A** new KISS/AMTOR/Navtex Firmware update is available to MFJ-1278 owners.

**MFJ's** powerful update is the most reasonably priced mulit-mode upgrade by any manufacturer. Contact your dealer or MFJ for yours today!

## MFJ Packet Radio



MFJ-1274 **$139.95**

MFJ-1270B **$119.95**

**MFJ-1270B** super clone of TAPR's TNC-2 give you more features than *any* other packet controller -- for $119.95.

**You** can double your fun by operating both VHF *and* HF packet because you get **high performance** switchable VHF/HF modems.

**You** get MFJ's new **Easy Mail**tm with soft-partitioned memory so you and your friends can leave messages for each other 24 hours a day.

**In** MFJ's new WeFAX mode you can print full fledged weather maps to screen or printer and save to disk using an IBM compatible or Macintosh computer with an MFJ Starter Pack.

**A** new **KISS** interface lets you run **TCP/IP.** They also come **NET ROM** compatible -- ***no modification needed!***

**You** also get 32K RAM, a full one-year unconditional guarantee and you can use 12 VDC or the included 110 VAC power supply.

**For** dependable HF packet tuning, the **MFJ-1274** gives you a high resolution tuning indicator that's accurate to within 10 Hz -- and it's only $20.00 more.

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# BITS & BYTES

*by Lacy McCall, AC4X*
*3001 Zelda Drive • Montgomery, AL 36106*

Put on your bifocals and read between the lines. This grab bag contains a few things you may need to read twice. I feel sure editor Tom Arvo won't mind if you share some of this invaluable info with a friend, but if you do, please don't fail to mention that the wisdom came from Digital Digest.

**THE OLD GRAY MARE...**

She ain't, is she? This month, we will take a look back and then maybe a peek into the future at a few new things. It is true the old gray mare ain't what she used to be, and it is also true that ham radio is not the same now as it was in the past.

It is not a good idea to be pessimistic about the world we live in. Enjoy what is around you and the opportunities you have. They are surely not the same, but they are nevertheless rewarding. Electric lights and running water are a great benefit, but they did create a lot of environmental abuse with all the trenches, poles and wires.

Why did you get interested in Amateur Radio in the first place? Was it because your neighbor or father was a ham? Do you like to tinker? Maybe you get a kick out of letting your radio travel half way round the world to be acknowledged by some unknown person in a foreign land.

The reason Amateur Radio attracted you, is probably not at all what keeps you interested in the hobby. You've changed, and grown older and hopefully wiser. You also have found that this diverse hobby has offered you something you never expected.

Today, tubes are a thing of the past, even though my favorite rig is an old Drake C-Line which is all American. Transistors are here and what a job they do. My Icom 735 really does make it easy to be a Ham. Let's look at the bright side of our hobby and be a little introspective. You may be an old gray stud, but Amateur Radio is still a young gray filly.

**LATEST GREAT DEBATE...**

Very likely, you've been told that if you want to stay out of an argument, don't discuss Religion or Politics. Now you can add NoCode. The furor rages and I hope you are not expecting me to be an absolute fool and take sides.

If you watch the vhf messages flowing to the ALLUS by-line, you can see all the arguments and all the counters. Each has a legitimate position, under our wonderful system that permits freedom of speech, even by an idiot. Even some of the arguments made for an against make sense.

What has amazed me is that some responsible people use such poor english and in this age of automation, where you know they are using computers to draft this opinion, these proponents don't take time to run the speller. (Did you find a misspelled word in the previous paragraph? - oops).

I'm not sure what will happen with the NoCode license, but I suspect if we are lucky to live for a few more years, we will see it happen. All things change, and amateur radio is not excluded. You can blame deregulation, socialism, or most any other thing you abhor, but change will take place over time. Today, very few hams spend any time at all constructing their own equipment. That was the heart of the hobby 20 years ago. When you built your rig, you understood why and how it worked, and operating was a real point of pride because you made the damn thing; even if you did get reports of an AC hum on your signal. That has changed, along with a million other things and we must adapt.

So, if NoCode comes along, be sad that many of the new hams will never know the joy of copying that weak long path cw signal at 2 am in the morning; but, be heartened, our very diverse group is striking for new frontiers. Maybe, even a guy that can't copy cw, is not all bad, and maybe he will have a speller and be able to use reasonably good english.

**WAY BACK WHEN...**

For some time now, I have had the opinion that two things in this century have been the most dominant in shaping our everyday lives. The first probably spawned the second, but both are equally notable.

World War II came at a time in world history, when we were about to awaken to the technological wonders of science. In the case of the USA, the event caused a whole generation to be thrust into a world setting, almost overnight. In 1940, most people in the United States, even urbanites, were still living a more or less rural, slow paced life style; and then WHAM. Young men were shipped to live and fight all over the world. Others were working in factories for the first time. The song says "how you gonna keepem down on the farm, after they've seen Pariee?". And that's just about what happened.

After WWII, we had a generation of free thinking, free living, well traveled men, who gave us leadership with some abandon. What was a business risk after war? That generation changed America and the world, I am convinced.

The second thing that has impacted society, it's values and outlook is Television. Undoubtedly, the technology developed or started during WWII, brought us TV a lot faster, but after it arrived the Television Phenomenon took a life of his own. Those as old as I, can realize how marvelous the age of communication really is. We know everything that happens everywhere in seconds. We know what others think, immediately. We find out all about things we never even heard of before. All we have to do is listen and watch. Between the mid 50's and now, we have changed and the pace has quickened. I think the WWII generation and their child, television were the two movers; good or bad.

**RECENTLY HEARD ON HF...**

Lots of stations are now getting on HF using the digital modes. If you don't believe me, just tune the bands. Most of my listening has been on 10 meters during the day and 20 meters other times when the band is open, but these two are really getting a workout.

Would you believe, I just encountered my first "digital band cop". I'm sure he was a well meaning, and he just wanted to be sure I understood the law (i think I do). In a hobby that is more or less self policing, I guess we need band cops, but I'm sure glad I'm not one. It would be tough to have to give up all that time doing public service, thinking everyone is a crook, when you could be having a lot of fun talking to nice people about nice things.

We do have a good many changes that have taken place in the FCC rules regarding digital transmissions. Make an effort to get the latest "FCC Rule Book" published by the ARRL.

On the bands, during weekdays, you can find a slot without too much trouble, but on weekends it is really crowded. A few tips for operating on HF:

**1-** LISTEN before you key up ... (good idea on any band) Since AMTOR ARQ is a Link, you can hear any station linked to another. Chances are if the frequency is quiet, it is clear.

On RTTY, it is another thing altogether. Just the same as CW or SSB, the station that you can hear may be in QSO with a station you can't hear, and may not be transmitting when you tune. Take some time to determine if it is your frequency. The same is true for FEC, but most stations I hear, use FEC only for calling CQ or QRZ.

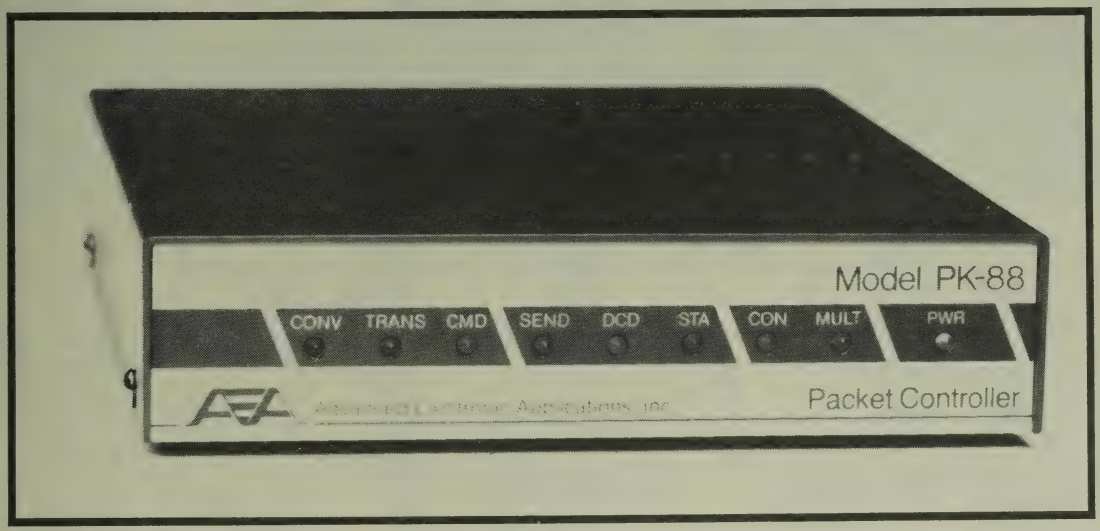
**2-** Unlike VHF (Packet), where you can operate on a fixed frequency and never hear any transmission, on HF it is a good idea to leave your speaker on. I keep the headphones plugged in and laying on the desk so the signals can be heard faintly.

*(cont'd page 15)*

## New AEA PK-88

# Packet Radio's Fourth Generation

**AEA is proud of its contribution to the packet revolution in amateur radio. We were the first manufacturer to provide a commercial packet controller. Our newest controller, the PK- 88, is the fourth generation in a proud line.**




Improved hardware and software design make the PK-88 your best choice for a packet only controller. Integrating the popular packet software from the multi-mode PK-232 with a special AEA TNC hardware design gives you the best of both worlds.

**The new Maildrop feature of the PK-88 gives you the convenience of a personal mailbox.** You can program 8K of memory in up to 15 different files with information that others can download. This information can be programmed for retrieval by a specific callsign, or made available to all connecting stations. Maildrop will also store incoming data sent to your station. The PK-88 is compatible with the popular TCP/IP protocol, and can be modified for NET ROM operation. The unique host mode of the PK-88 also gives programmers the ability to write special terminal programs (like AEA PC Pakratt and Com Pakratt programs) for full featured TNC use. Other software features of the PK-88 allow the operator to restrict the use of the station for both connects and as a digipeater. The mailbox monitoring command allows monitoring without displaying the callsign headers, while standard monitoring includes both MFROM and MTO lists.

For base station, portable or digipeater operation the PK-88 makes packet radio easy and affordable.

**Amateur Net Price $119.95**

AEA Brings you the Breakthrough

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# N.E.P.R.A. / N.Y.S.P.R.A. / E.B.N. network backbone map
rev 3.19 3/06/89

*by KA2DEW*

**Duplicate at will!**

| BBScall | nodename | nodecall |
|---|---|---|
| KA1MGO-1 | SNHUBF | K1TR-2 |
| WB1DSW-1 | MBOS2 | N1CSI-2 |
| N1BGG | MBOS2 | N1CSI-2 |
| WA2PVV | ALB144 | WA2WNI-1 |
| WA2WNI-4 | ALB220 | WA2WNI-2 |
| K1MEA-4 | MTM | K1MEA-1 |
| WA2UMX | #WMA2 | K1FFK-12 |
| N1API | MTM | K1MEA-1 |
| KB4N-4 | SNHUBF | K1TR-2 |
| WA2YVL-4 | MWU | W1HJF-4 |
| WA1OJB-4 | MWU | W1HJF-4 |
| WA2RKN-2 | ENY | WB2KMY-1 |
| K1UGM | SNHUBF | K1TR-2 |
| WA1ZDA-5 | PENBAY | WA1ZDA-1 |
| WB2COY | CLV | N2CJ-1 |
| W1NY | BERK2 | WA1TPP-13 |
| W1AW-4 | BERK2 | WA1TPP-13 |

BBS information listed here shows network connect info for each BBS. Some BBSs are for local use only and will refuse network connects to non-BBS callsigns.

Network Developer Items:
>A protected backbone is a path between two or more nodes where there are no hidden transmitters. Stations not assigned to a backbone should not attempt over the air connects to a backbone node as this could degrade backbone performance.
>Only protected backbone nodes use the # symbol in their names.
>An unprotected backbone is one where hidden transmitters have been allowed.
>User nodes accept connects from man or machine.
>Protected backbone nodes accept connects for diagnostic purposes but are unusable for re-connect.
>Digipeating through user nodes is reasonable if retries are unlikely to occur as the timing on TheNET nodes used as single frequency nodes is poor.
>We don't want to add new nodes to an unprotected backbone except where it is neccesary to insure redundancy.
>Due to the fact that most users use 2 meters for packet and the rarity of 2 meter spectrum we should at all times use higher frequencies to access the network if possible. It is much cheaper to have 1 BBS connect to the network on 220 than to have 20 users do so.

220/440/900 frequencies used:
221.03 - protected backbone GRFTON KNDRHK BTRNUT
221.05 - unused
221.07 - YCCC backbone, CT, MA, NH
221.11 - unprotected backbone in Ct, NY, Ma, RI. (BBSs + TheNET)
221.13 - protected backbone VNH, CENTNH, SWNH
221.15 - protected backbone CENTMA, SUD, SNH
221.17 - EBN lan from Mt. Greylock (BBSs + TheNET)
221.19 - reserved by EBN for NY, Ct region
223.42 - Lan from Hope, Maine (any users)
223.54 - protected backbone SVT, GRFTON
223.56 - protected backbone MTM, CENTMA, BERK
223.58 - lan from Grafton NY (any users)

441.000 - NYCUHF lan (any users)
441.025 - SNHUHF lan (any users)
441.050 - protected backbone SVT, CENTMA, SWNH
441.075 - protected backbone CLV, KNDRHK
441.100 - unprotected backbone in seNY, Ct, Me (TheNET)
441.125 - unused
445.1 - protected backbone CENTNH, SNH, SUD, and BERK,BTRNUT
445.6 - unprotected backbone in NH, Me, Ma (any users)
445.65 - protected backbone ALB, GRFTON SRTOGA

This map shows TheNET and Net/rom nodes which are connected to each other on 50mhz or 220 and above. This map does not show Servers, Users, KA nodes or 2 meter single port nodes (except where those nodes are committed to having a HTS free backbone in short order **).

Don't let all this fool you. We desperately need more people to help. We're just getting started!

New Hampshire

Maine

Vermont

Massachusetts

Rhode Island

Connecticut

New York

to YSC VE2RKL Sherbrooke

MW bb
W1HJF
Mt. Washington, NH

PENBAY bb
WA1ZDA
Hope, ME

VNH
WA1TLN
Mt. Ascutney, VT

CENTNH bb
K1BKE
Concord, NH

SWNH
KA1BBG
Keene, NH

SVT
K2AEP
Dover, VT

SNH
K1TR
Windham, NH

NCMA
N1EZD
Templeton, MA

MBOS
N1CSI
Wakefield, MA

SUD
W1DA
Sudbury, MA

CENTMA
KA1OXQ
Oakham, MA

SPNGFD
W1NY
Springfield, MA

BERK
WA1TPP
Granville, MA

MTM
K1MEA
Mt. Tom, MA

BTRNUT
KA1OA
Gt. Barrington, MA

WMA bb
K1FFK
Mt. Greylock, Ma

ALB bb
WA2WNI
W. Grafton, NY

GRFTON bb
K2CBA
E. Grafton, NY

KNDRHK
WA2MMX
Chatham, NY

SRTOGA
KA2FQE
Saratoga, NY

We need nodes from SRTOGA to the north country

A node here would help

AUB
WA2VAM
Auburn, NY

ROCHES **
K2JD
Rochester, NY

SYR
WA2VAM
Syracuse, NY

UTICA
N2GFN
Utica, NY

COR **
WA2VAM
Cortland, NY

ALP **
N2EZG
Alpine, NY

CNY
KA2CTN
Solvay, NY **

CNYPA has 2 new nodes on the air in the past 2 weeks and I am informed that there are 4 radios/TNCs to be added into the system as backbone support in the next 2 weeks.

We need a node between Easton and the NYEPRA network

To Easton, Pa

ENY
WB2KMY
Mt. Beacon, NY

To NYC, NJ, Pa

CLV
N2CJ
Lagrangeville, NY

NWCT
WA1UQC
Birlington, CT

We need nodes in CT, RI connected with no HTS

PVD
W1XJ
Providence, RI

EBN backbone

445.01 · 445.6 · 445.65 · 221.13 · 221.17 · 221.03 · 441.075 · 145.09 · 223.54 · 441.05 · 445.1 · 221.15 · 223.56 · 431.11 · 51.93 This path under test

| USER PORT INFO: | | | |
|---|---|---|---|
| site | freq. | node | callsign |
| UTICA | 145.05 - | UTICA | :N2GFN |
| COR | 145.01 - | COR144 | :WA2VAM-9 |
| SYR | 145.01 - | SYR144 | :WA2VAM-1 |
| AUB | 145.?? - | AUB144 | :WA2VAM-? |
| | 223.58 - | AUB220 | :WA2VAM-? |
| SRTOGA | 145.01 - | SRTOGA | :KA2FQE |
| ALB | 144.93 - | ALB144 | :WA2WNI-1 |
| | 223.58 - | ALB220 | :WA2WNI-2 |
| GURU | 145.03 - | GURU | :K2CBA-1 |
| KNDRHK | 145.07 - | KNDRHK | :WA2MMX-1 |
| ENY | 145.59 - | ENYLAN | :WA2KMY-2 |
| | 145.01 - | ENY | :WA2KMY-1 |
| CLV | 145.09 - | CLV | :N2CJ-1 |
| WMA | 145.05 - | WMA | :K1FFK |
| BTRNUT | 145.?? - | BTRNUT | :KA1OA-? * |
| BERK | 145.07 - | BERK1 | :WA1TPP-12 |
| | 221.11 - | BERK2 | :WA1TPP-13 |
| MTM | 145.05 - | MTM | :K1MEA-1 |
| SPNGFD | 145.01 - | SPNGFD | :W1NY-1 * |
| SVT | 145.?? - | SVT | :K2AEP-1 * |
| CENTMA | 145.07 - | CENTMA | :KA1OXQ-1 |
| VNH | 145.01 - | VNH | :WA1TLN-1 |
| SWNH | 145.05 - | SWNH | :KA1BBG-1 * |
| CENTNH | 144.99 - | CENTNH | :K1BKE-1 |
| MW | 145.01 - | MWV | :W1HJF-1 |
| | 445.60 - | MWU | :W1HJF-4 |
| SNH | 145.07 - | SNH | :K1TR-1 |
| | 441.025- | SNHUHF | :K1TR-2 * |
| MBOS | 145.01 - | MBOS1 | :N1CSI-1 |
| | 221.11 - | MBOS2 | :N1CSI-2 |
| | 445.60 - | MBOS4 | :N1CSI-4 |
| SUD | 145.09 - | SUD | :W1DA-1 * |
| PENBAY | 145.05 - | PENBAY | :WA1ZDA-1 |
| | 223.42 - | PBARC1 | :K1ERO-1 |

* = planned user port

** = committed to having HTS free backbone connect

SITE NOT ON THE AIR, YET

bb = emergency power

=This link would be a good idea but no equipment has been put aside at this time.

Bold line = protected backbone (no hidden tranamitters)

## Networking Rules:
1> No hidden transmitters on backbones.
2> No nodes of poor reliability pass into backbone.
3> No single port nodes.
4> Path redundancy to all sites is necessary.

This map was submitted by Tad Torborg, KA2DEW to show the efforts being made to link the northeast with a viable Packet network. We thought it might have some constructive value for others of our ilk planning similar networks. For more information, contact Tad at (603) 992-1455 or write to him at: 7 Jefferson St., Nashua, NH 03060

- Editor -

This map shows the goals of our organizations. Some details are inaccurate at press time. Specifically: MBOS, CENTNH, MW and SNH are all connected by 445.6. SNHUHF is still on 445.6. Albany 445.65 backbone is incomplete. CLV talks directly to GRFTON on 441.075 until KNDRHK is put on the air. SRTOGA talks to #WMA2 on 221.17 and is not on 445.65. UTICA is single port on 145.05.

Comments, Corrections, new info: call me at 603-882-1455 up until 11:30 PM.
KA2DEW - Tadd Torborg, Nashua, N.H. @WA2WNI
for keyboard to keyboard my station is off of SNH:K1TR-1
USmail at 7 Jefferson St. Nashua NH 03060


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by Jonathan L. Mayo, KR3T
3908 Short Hill Drive • Allentown, PA 18104

# Terminal Emulation Programs

— PART 2 —

This article is a continuation of the discussion of microcomputer based terminal emulation systems begun in the previous issue of Digital Digest. In Part I of this two article series, I introduced the concept of terminal emulators and went over the features that amateur digital communications operators should look for in terminal programs. In this article, I'll cover some of the more popular terminal programs available for a variety of microcomputer systems for use specifically in amateur digital communications.

As a brief recap of Part I, perhaps the most popular use of microcomputers in digital amateur radio stations is as terminals for packet radio TNCs (Terminal Node Controllers), RTTY TUs (Radio-TeleType Terminal Units), or some other digital communications interface. All microcomputers that act as digital communications terminals are running some sort of terminal emulation software, a program which allows a computer system to act like (emulate) a dedicated digital communications terminal. Part I covers the basics of terminal emulator software. After reading Part I, you should have a good understanding of what features you need in a terminal emulator software package for use in amateur radio digital communications.

**Why Amateur Radio Specific Software?**

Terminal emulation software written specifically for amateur radio digital communications use has many advantages over standard landline telecommunications software. Ir. the same way that some ASCII telecommunications are programmed to make u se of the Hayes command set in landline modems, many amateur radio related terminal programs include support for specific digital communications interfaces. Often, the manufacturer of the digital communications interface unit will also sell a terminal program that is written to work well with their interface unit. Some of these programs are covered in the next section.

**Popular Programs**

There are numerous terminal emulation software packages available for use in amateur digital communications. This section introduces some of the more popular programs for various microcomputers. This is by no means a complete list and is in tended only to give you some background knowledge of available programs.

If you own an IBM-PC compatible computer, you have a wide range of programs to choose from. The Commodore 64 and 128 microcomputers are also well supported. The number of amateur radio related terminal programs for the Apple Macintosh serie s of microcomputers is growing. Other microcomputer systems such as the Apple //e and TRS-80 Models I, III, and IV also have several amateur radio related terminal programs available for them.

Should you own a microcomputer system that is not covered in this series, do not despair. While there may not be many popular amateur radio related terminal programs out for it, it is always possible that one exists somewhere or a regular landline ASCII telecommunications package can be configured for amateur radio use. See Part I of this series for more information on locating software for your system.

The AEA PK232 is a very popular multimode data controller capable of operating on CW, Baudot RTTY, ASCII RTTY, AMTOR, Packet, and Facsimile. AEA also sells two terminal programs for use with the PK232 that take advantage of the unit's capa bilities. The first program is called PC Pakratt with FAX and is for IBM-PC and compatible microcomputer systems. A similar program called Comm Pakratt is available as a ROM cartridge for the Commodore 64 and 128 microcomputers. Both programs have a split-screen display (in which the computer's screen is divided into two parts, one where incoming data is displayed and the other where typed data to be sent is displayed) and can transmit and receive facsimile. Contact AEA, Advanced Electronic Applications, 2006 196th SW, Lynnwood, WA, 98036 for more info.

Another example of manufacturer written terminal programs for specific digital communications interfaces is Kanterm, Pacterm, and MAXFAX from Kantronics. Kanterm is for the Commodore 64 and 128 microcomputers, and Pacterm is for the IBM-PC a nd compatibles. MAXFAX, a program for the reception and storage of facsimile images, is available for both computer systems. These programs are designed to work with most Kantronics digital communications interfaces, such as the KAM and KPC-4. For more information, contact Kantronics, 1202 East 23rd Street, Lawrence, KS, 66044.

There are also many terminal programs available for packet operation with various TNCs. PC-Packet is a packet terminal program for the IBM-PC and compatibles and features a split screen, windows, and a receive buffer. It is designed to work with most TAPR compatible TNCs. PC-Packet is distributed by PacComm. Contact PacComm at 3652 W. Cypress Street, Tampa, FL, 33607.

The Apple Macintosh has two well respected packet terminal programs available for it. The first, MacPacket, features a split screen, a receive buffer, and digipeater routing tables. MacPacket is also distributed by PacComm. The other Macintosh packet terminal program is Macket. Macket is a powerful packet telecommunications program for the 512K, 512e, Mac Plus, Mac SE, and Mac II computers. Extensive windowing, special host-mode support for many TNCs, and uploading and downloading are some of its many features. Macket is distributed by S. Fine Software, P.O. Box 6037, State College, PA, 16801

These programs are meant to give you an idea of what is available. They range in price from twenty dollars to forty dollars; contact the distributors for specific pricing and minimum microcomputer configuration information. If you are using a terminal emulation program that you feel is well suited to amateur radio related digital communications, please let me know about it. If I learn of other useful terminal programs, I'll write about them in future articles.

**Conclusion**

This two-part series on terminal emulation programs was written to give you a basic understanding of the advantages of microcomputer based terminal programs, outline what features you should look for in terminal programs, and showcase several popular amateur radio digital communications programs. Using the information in this series, you should be able to locate several terminal programs for your particular microcomputer, weigh the features of each program, and select one that best fits your needs.

## WEFAXWORKS...

is a new computer program from Kantronics designed for the Apple Macintosh which allows reception of weather maps and charts on a standard Mac. The program allows the user to display one line of the picture, then skip to a selectable number of lines before displaying another.

The user can also skip 0-5 lines to allow at least one line of every 6 to be displayed on the Mac screen. During live reception, the screen will scroll automatically when the bottom line is reached. There are more features included than can be enumerated here. For further information, contact Kantronics, Inc., 1202 E. 23rd street, Lawrence KS 66046.
Phone (913) 842-7745
*- Source: Westlink Report -*

*(cont'd from page 10)*

**3-** HF packet is very busy and it is hard to get a good connection when you are on the same frequency as hundreds of other stations. If you make a contact, try to have a clear frequency in mind and then QSY. You will have a much more reliable connection.

**4-** Where there are a lot of BBS stations on a given packet frequency, try to avoid that frequency unless you have BBS business. Remember, if you are interested on running a BBS on HF, use good operating practice and know the FCC rules related to Automatic Operation and Third Party Traffic.

**5-** Train your ear to the different Digital Signals. Listen for a while and you can soon easily detect the different modes. If you are having trouble copying a signal try the opposite sideband or use RXR on a PK232.

**HOSTMODE REVISITED...**

Since I have received no poison pen letters regarding my comments on "Hostmode" in the last issue, as befits the critic, I am now in the midst of a project using Hostmode. Clearly, there are some things that you can do "computer to computer" that are not possible otherwise, and it is nice to have a chance to look closely at Ron Raikes' (WA8DED) implantation. As far as I know, there are only two versions of Hostmode available.

The first is WA8DED hostmode firmware for the TAPR TNC and which is used by the DRSI PC*Packet Adapter board, among others. The second is AEA's version used in the PK232.

Without getting too technical, which is easy for me, the differences are primarily in the technique used for data transmission. The AEA version uses Start and Stop characters in the data stream, whereas Ron uses the data channel number as the Start character, the length of characters to follow and finally unterminated data.

If you are interested in such things, take some time to explore hostmode. Without repeating previous comments, I don't think it is the answer in every application, but Ron Raikes has given us an invaluable tool that is well conceived and well done. Don't overlook it.

**THE USPS MAIL BAG...**

It is nice to hear from readers, particularly when they are supportive and one thing I know that Digital Digest strives for is to be of as much value to hams as possible. Please don't hesitate to drop a note to me or the magazine to let us know if we are on target. If we are not and can make the publication more useful to you, speak up.

Two items worthy of note arrived here recently. The first was a nice letter from Ed Kulesa (K2VEE) who shared some of the same opinions expressed in my initial column regarding packet radio. What I had hoped, was that more people would think more deeply about where we are going and Ed is doing just that.

The second item was a real ray of sunshine on a cloudy day. KA2DEW, Tadd Torborg, sent a flier telling about the N.E.P.R.A - N.Y.E.P.R.A - Eastern Backbone Network serving eastern New York, Connecticut, Rhode Island, Massachusetts, New Hampshire and Maine on VHF Packet. The one page, two sided info sheet is packed with information and includes a system map,a description of the system, how to use it and the objectives. The network is striving to eliminate the "Hidden Transmitter" and appears to be making real progress. In addition, individual operators are encouraged to use and explore the network and as the pamphlet says, "play radio". I really like that. Cheers to Tadd Torborg, Dana Jones (WA2WNI) and all the New England/New York group for an outstanding effort.

**NEW SOFTWARE...**

If you are into unraveling programs or do much debugging, you may be interested in a program called "Sourcer" by V Communications of San Jose, California.

My copy just came in a couple of days ago, and this in not intended as an endorsement of the software or an in depth review of the software, but it does a good job if dis-assembling EXE and COM files.

As documented, Sourcer produces the assembly code which you may edit and re-assemble to make any desired changes. This should only be done where it is not in violation of any copyright laws or on your own software, but when you need such a tool, Sourcer will do the job.

Another new addition here is the "C/Database Toolchest" by Shrier and Deihl, which is licensed to and distributed by MIX Software, Inc. of Richardson, Texas. The library, which is available with the C source code, includes a B' Tree Library, ISAM Library, a sample database program and several utilities. Without talking dollars, I can tell you it is a real bargain, and appears to be a well organized and comprehensive file library.

**ON THE LIGHTER SIDE...**

If you can't poke fun at a friend then whom may you poke? I just heard about a program so dangerous, I won't tell you the name. As I understand, this new software is intended to be used on packet network frequencies.

What it does, if the report is true, is to monitor the frequency and log all traffic. It sort of eavesdrops on the BBS systems and keeps up with such things as network efficiency (number of retries; failures etc.), who got what and the activity.

Under conditions where traffic slows, this program then goes into full swing. Using pre-sets for topics, headers and such things, it generates messages to be dumped into the system to bring it back to an active state. When things get too slow, this program speeds them back up by providing traffic.

I'm not sure how much sense you could make of the messages, but then maybe they would not be much worse that some I've seen that are not computer generated. I for one, hope the program crashes and will boycott it's use if it shows up around here. It's nice to have a quiet frequency every now and then.

## Golden Classics of Yesteryear...

is a new publication by Dave Ingram, K4TWJ recently announced by MFJ Enterprises, Inc.

Remember the 6L6 rigs, Heathkit DX-100, Collins KWM-1, WRL Globe Scout, Hallicrafters, RME, Hammarlund, National HROs, Eimac tubes, E.F. Johnson, WWII rigs... ARC-5, BC342/348... and bugs by Vibroplex, SpeedX, DOW KEY... Etc.

All these famous names plus many more you'll recognize are in K4TWJ's "Golden Classics of Yesteryear." It's all ham radio in content and it's jam-packed with real life tales, transmitters, receivers, favorite circuits, telegraph keys, bugs and other ham radio topics.

Easy-to-build weekend projects - transmitters, receivers and other projects - are included from the 1920s, 30s, 40s, and 50s.

K4TWJ even shows you how to build a classic "Tailender"... an early DX memory keyer that requires no power supply or other electronic parts and works like a champ.

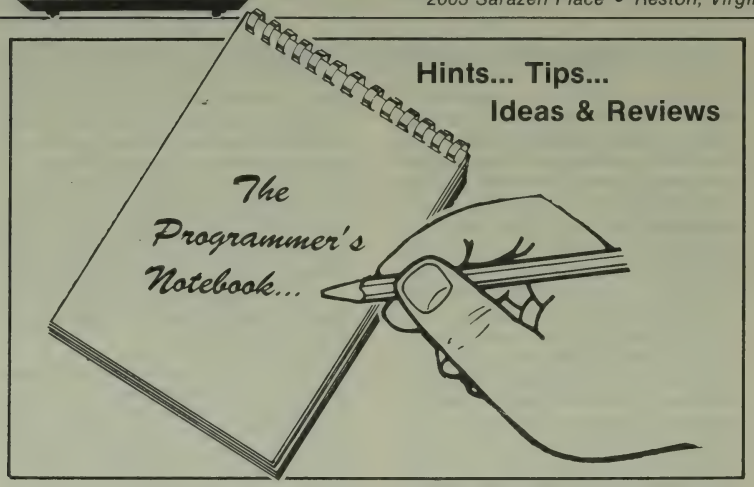
K4TWJ is an accomplished collector of classic radio gear and he shows you how to collect, restore and operate classic gear.

Dave Ingram, K4TWJ, is one of amateur radio's most recognized and respected authors... especially in classic gear. He has authored over 300 articles and 12 books.

"Golden Classics of Yesteryear" is priced at $9.95 and is available through amateur outlets or direct from MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762 or call (601) 323-5869, Toll Free 800-647-1800.

*by* ***Peter G. Smith, N4ZR***

*2003 Sarazen Place • Reston, Virginia 22091*




As I sit down to write this column I've just been grazing through the truly incredible 3 Winks BBS, run in suburban Washington, DC by Stan Staten, W3INK. Stan has an immense collection of public domain software and shareware available on line. Anyone who overlooks bulletin boards (especially those run by hams) as a source of potentially useful software is missing a real bet. For those who are interested, the telephone number is (301) 590-9629.

Another good bet, also in the Washington area, is Der Spiten Sparken Board, run by Dick Miller, WD4AZG, at (703) 791-6198. This board is also the home of TOTALHAM, a shareware database program that Dick wrote to be his answer to the problem of not having the proper program running or not having information he needed at hand when he was on the air. I'm in the process of testing it now, and should have a review shortly.

There are a number of other ham BBSs around - I exclude VHF packet only because I haven't yet tried it - and as I sample their wares I'll let you know what I've found. The people who provide this public service often invest truly significant amounts of money in their hardware, not to mention the hours each week that they spend keeping the systems running and (hopefully) mischief-free. It's a matter for your own conscience, of course, but if you use such a board regularly, and the operator asks for a donation to help support it, I'd encourage you to do it.

One of the tricky questions we all face when confronted with the apparent cornucopia of riches on a BBS is which of them to spend the time downloading. It can take a long time to download many of these, even at 1200 or 2400 baud. That can add up to money, if you're on a commercial service like Compuserve, or making a toll call. It can be pretty frustrating to download software, only to discover that it isn't what you thought it was, or has serious bugs. In an effort to help you avoid this, I plan to tip you off to some of the really good ones in this column, with enough description that you can decide for yourself whether you want to track them down somewhere.

One, that I mentioned last month, is K1EA's excellent contest logger, CT - the only problem is that Ken and the Yankee Clipper Contest Club are updating the software so rapidly that it's difficult to be sure you have a current version. I have just received CT version 4.25. Ken really unveiled CT to the world outside YCCC only last spring at Dayton, and a rough count on 3830 after this fall's CQWW contests indicated that about half the top scorers were using CT.

This is one piece of shareware that is well worth registering for. I promise a full review soon, but I want to hold off until after the ARRL CW DX Contest, when I expect to give it a good workout, and after I talk with more of the top contesters who have used it, to get their assessment. If you don't want to wait, you can write Bill McGowan, KC1EO, 33 Truell Road, Hollis, NH 03049 USA, with $25 in US funds, to receive your own registered copy, complete with the excellent "professional" documentation, or send me a formatted 360-k disk and a disk mailer with sufficient postage, and I'll send you a copy with documentation on disk.

**Back to BASIC(s)**

Last time I promised to discuss why BASIC may be the only programming language you'll ever need. To reveal my prejudices completely, it is the language I used in the Contester series of real-time logging software, and the only language I've ever felt the need for. I've done some work in Pascal, and even a bit of Assembler, but always came back to BASIC.

Aha, you say. Everybody knows that REAL programmers work in C, or Pascal, or Assembler. BASIC is slow, its syntax is limited, and it encourages sloppy programming. Compare it with the terse elegance of C, the structure of Pascal, or the direct control of Assembler, and how could anyone still want to use BASIC?

BASIC is almost everyone's first programming language, because of its accessibility. It's built into every Commodore 64... in fact the machine comes up in BASIC mode - and comes with virtually every IBM and IBM clone. When I decided to move on from private experimentation to writing for other people, the first decision I had to make was whether to learn a new programming language first. I decided not to, and my reasons may also be convincing to you.

I was concerned about the slowness of BASIC, and particularly about "garbage collection." For real-time software, with demanding response requirements, this could have been a show-stopper.

The answer to the slowness question turned out to be pretty easy. BASICS come in two varieties, interpreted and compiled. In interpreted BASIC, your system "reads" a file containing the BASIC program and "interprets" it into a form that can be executed by your computer. In compiled BASIC, that program file is put through a separate process called compilation, which creates another, executable file. When you want to run your program, you run the executable file. Compiled BASIC runs, in the case of the Commodore 64 and the compiler I use, 5-10 times as fast as the interpreted version.

So what's "garbage collection", and why does it matter? When a computer running BASIC is asked to deal with a large volume of string expressions (text, or mixtures of letters and numbers, like callsigns), and particularly to process them in ways that reassign the value of string variables, then garbage is collected. Say, for example, that you write a program that has you input a callsign, and assigns it the variable name A$. The next time that you input a different call-sign, the computer writes the new value to memory, but the old one remains in another location. Sooner or later, all the available string space is used up. At that point, the computer does what is known as "garbage collection", deleting all the obsolete string variable values from memory, keeping only the latest one.

*(cont'd next page)*

*(Cont'd from previous page)*

If you only have a few variables, this happens very quickly. But if you have used an array in which strings such as call-signs are stored (for instance, in a duping program), then the computer sees a very large number of string variables. Commodore 64 BASIC's garbage collection slows down in proportion to something between the square and the cube of the number of string variables. In one case, with a 2500-call duping array and additional arrays for CQWW countries and zones, I have measured a garbage collection time with interpreted Commodore 64 BASIC of over 3 minutes!

So what? Well, chances are if you have used a duping program in most flavors of interpreted BASIC, you have run into this problem. You'll be chugging along, and suddenly your keyboard locks. No matter what you do, nothing happens for a while, and then mysteriously everything is all right again. If you're impatient, you may have concluded that the program has crashed, but it really hasn't. It's just doing garbage collection.

Well, the answer in the case of the Commodore, both for speed and for garbage collection, is the same - the BASIC-64 compiler from Abacus Software, which was actually written by a German company called Data Becker. My hat's off to these people. Their compiled BASIC has virtually undetectable garbage collection delays, runs very fast, and offers many powerful options. The compiler is also dirt cheap under $40 the last time I checked - and very reliable. The only drawback is that it takes time to compile, but that's true of any language, and BASIC has one great advantage -you can run your programs or subroutines in interpreted form, get the bugs out, and then compile them for real-time use when speed is important.

For the IBM world, any of the available compilers should do the job. I have checked the QuickBASIC compiler, and have verified that it does very fast garbage collection and runs acceptably fast, even on a 4.77 MHz PC.

So what about the other issues? It's true that Commodore BASIC and, to a lesser extent IBM BASICA or GW-BASIC all suffer from a relatively limited assortment of commands, including some found in other languages that are very useful for writing tight, fast programs. But help is on the way, particularly for the IBM (and Macintosh environments) with Microsoft QuickBASIC. Without getting into heavy tech, QuickBASIC combines the best of the interpreted and compiled forms of BASIC, gives you a very efficient and convenient programming "environment" (their word for the combination of screen editor and other features that make programming easy), and adds a number of powerful features to the BASIC language that make it much more the equal of the "big kids." It breaks through the traditional 64 Kbyte limit on program size by using a modular structure that will let you write programs as big as you want (though even my CQWW program with duping and automatic country and zone tracking only took about 23K). It has full support for color and monochrome graphics, supports binary files, and permits userdefined data types to make randomaccess file input/output much easier (you can define an entire log entry, for example, with both numeric and string data included, as a single variable). Instead of those old BASIC bugaboos, line numbers and subroutines, QuickBASIC uses mini-programs called procedures, which are called by name from the main program.

That gets me to the final beef with traditional BASIC - the charge that it can't be used to write structured, organized program code. It's true that BASIC will PERMIT you to write tangled, confusing programs if you choose - in fact I still run across examples in my own stuff that make me cringe. But it doesn't have to be that way, even with traditional BASIC. As I argued last time, if you understand the task you're trying to achieve, you can break it down into bitesize pieces. Once you've done that, in traditional BASIC, forget about the GOTO command, and use only GOSUBs. In QuickBASIC, the problem will take care of itself. Either way, all it takes is self-discipline, and you'll be glad if you start writing this way from the first. There's nothing harder than trying to modify a program that you wrote long ago, when it is internally disorganized so that its structure is no longer obvious, even to you.

So fundamentally there's nothing wrong with BASIC, and a lot right. BASIC is very good at manipulating string variables, the combinations of letters and numbers that are fundamental to duping, logging, and DXCC tracking, among other common applications. And as I said earlier, with BASIC it's easy to start programming. You can sit down with your Commodore 64, even if you've never programmed a byte, and begin from the "READY" prompt. There are example programs in the documentation that comes with each Commodore, and more in the Commodore "Programmer's Guide." The absolute best reference for Commodore BASIC, though, is "Programming the Commodore 64" by Raeto Collin West, available from Compute! Books. You could do a lot worse, as a basic tutorial, than to read through its BASIC keywords reference section, trying all the examples. I have yet to find an error anywhere in this thick book of tricks. It covers BASIC, machine language, hardware, graphics and sound, the works! Worth twice its price of under $20.

For those of you who are already into programming, I'm sure the above has been pretty elementary. Next time, I promise to get more technical. I'll trot out an optimized hashing algorithm that can be built into programs to do about anything from dupe checking to extracting country information from call-signs.

(con'd from page 7)

Let's give everyone the benefit of the doubt and assume that your radios are nicely calibrated, are on frequency and properly modulated deviation on SPACE tone is LESS THAN 4 KHz -and you now connect to one of the area's many nodes. If that intervening node has any such frequency-error or improper modulation, then you're still subject to all of the above problems even though your own "act" may be clean as a whistle.

**RULE NINE: The Tool Is Less Important Than The Craftsman**

Find someone who has some kind of modulation and frequency measuring gear. It does NOT have to be a $12,000 professional service monitor. It can be as simple as a reasonably calibrated multi-mode VHF/UHF radio.

In the next article, we'll look at how one of these multi-mode VHF/UHF radios can be used to cure almost all the ills of digital radio.

## New MFJ-1278 Firmware & Software Ready...

MFJ has released new firmware that adds the AMTOR, Navtex, and KISS (TCP/IP) modes to their MFJ-1278 multi-mode controller. In addition, a new packet-radio function called "Easy Mail(TM) Personal Mailbox" allows the controller to act as a mini-PBBS with a command set that is familiar to all PBBS users.

MFJ has also released a new MFJ-1278 compatible terminal emulation program for the Apple Macintosh family of computers that includes the ability to print weather FAX pictures on the computer's display. The program, which is called MFJ-1287, includes an interface cable for connecting the computer to the controller. It costs $19.95. For more information, contact MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762.

*- Source: Gateway -*

*(cont'd from page 8)*

The user can tell the NAVTEX decoder that the user only wants to print messages with certain values of "a" and/or "b". So, if you don't want to see the messages that skip in from San Juan or New Orleans during the late night hours, you can tell the NAVTEX decoder to ignore those stations. Additionally, if you only want weather reports (category ("b" symbol) value set to E) you can tell the NAVTEX decoder to only print out messages with a "b" value of E -- that will get you only weather forecasts.

Once your decoder prints a message of the type you have programmed it to print, it will remember the header if the whole message has been received with no (or few) errors. Thus, once you have printed a message correctly, the NAVTEX decoder will ignore additional copies of the same message when transmitted during later broadcasts. If you get many errors the NAVTEX decoder won't store the header and you will get the message again on the next transmission. It's a pretty simple system but it works well.

There are some special cases for particular "b" and "nn" values. First off, if you have programmed your NAVTEX decoder to print messages for a particular station ("a" value) you will always print messages with that "a" value when the "b" values are either A (navigational warning), B (meteorological warning) or D (search and rescue information). Additionally, any message with a "nn" value of 00 will be printed every time it's received, even if it has been correctly received before.

**APPLICATIONS FOR AMATEUR RADIO**

So, of what interest is this NAVTEX system to Amateur Radio operators? Well... plenty. First and foremost, if you are located on the east coast you can probably pick up these broadcasts pretty consistently, even during the daytime, unless you have noise problems. These signals can serve to test the performance of your equipment. You can "square off" two AMTOR systems and see which works better, at least from an AMTOR FEC receive point of view.

Secondly, and perhaps more importantly, consider the use of headers to avoid printing a message more than once. Where might this be useful for Amateur Radio? Certainly, if the ARRL bulletin station, W1AW, included NAVTEX style headers you could set up a receiver and printer to the W1AW frequency and always have the latest bulletins at your finger tips -without printing the same messages over and over on subsequent broadcasts. Those amateurs involved with bulletin dissemination should find this helpful.

**AMTEX -- NAVTEX**

Let's take this W1AW NAVTEX HEADER concept further. However, before doing so, I would like to move away from the term NAVTEX when used on amateur radio circuits. NAVTEX implies not only using the "ZCZC abnn" headers but also the message content (i.e., marine safety) and operation on 518 kHz. To avoid confusion with the NAVTEX system proper, let's use the term "AMTEX" when refering to NAVTEX style headers used on amateur radio circuits. Now that we have defined AMTEX let's see how it might be combined with packet to some benefit.

One problem I see with packet is that it takes several days for bulletins to "propagate" throughout the packet network and reach the machine that I check into for messages. In some areas, local OBS people capture the bulletins from HF and post them to their local machine. This moves the bulletins faster to the local user but it requires manual intervention. What's needed is a method to automate the system. When the day's bulletins are first transmitted by W1AW at 6 PM eastern time wouldn't it be great if they are automatically posted to most all local VHF BBS systems around the country within 45 minutes? Let's explore how this might be done.

**BULLETIN INJECTION**

Consider a system that I call "Bulletin Injection" (BI). It captures "bulletins" from W1AW on HF, rejects those that are redundant or those with too many errors and "injects" them into the local VHF packet network. It works as follows.

The BI station consists of an HF subsystem and a VHF subsystem. The HF subsystem is composed of an HF receiver, an HF demodulator (maybe something like an ST-6 -- although old and now inexpensive, it still works great) and a TAPR TNC-2 (or clone). We set up this TNC to use the external HF demodulator that's connected to the HF receiver that's tuned to W1AW. This TNC has a new W1AW AMTEX EPROM installed in place of the packet EPROM. The VHF subsystem is a standard packet station formed by a transceiver and another TNC2. This TNC will be a stock unit -- no modifications. Now let's interconnect the two TNCs to each other via the RS232 port. Note that there is no computer or terminal involved here; the TNCs are connected to each other and that's it. The TNC on the HF port is "receive only" and has special W1AW AMTEX firmware installed. The TNC on the VHF port is full transmit and receive, everything standard.

When W1AW comes on the air and transmits bulletins that include the AMTEX headers, these messages are stored in the 32K RAM of the AMTEX TNC. A directory of all bulletins currently in the RAM is maintained, automatically, and it includes information about the number of errors in each message. The system administrator has also previously established a table of call-signs of BBSs that are permitted to check into the BI and notes how many errors (if any) each BBS is willing to tolerate.

Any local BBS that wants to have the latest bulletins can connect to the BI station and, through reverse auto-forwarding procedures, get them. Any duplicate bulletins would be ignored as would bulletins with too many errors. I don't think non-BBS stations should be allowed to check into the BI system, although they could. However, excluding non-BBS stations might avoid system loading problems.

One BI station could serve the needs of many BBSs. Alternatively, one BBS could poll the BI station and then forward the bulletins to all other BBS systems in a county, or state for that matter. The BI station could be colocated with a VHF packet BBS, or not. It really doesn't matter.

**BI TASKS**

So, what does it take to make Bulletin Injection a reality? Well, first, W1AW needs to incorporate the AMTEX headers into their AMTOR bulletin broadcasts. This is being worked on and hopefully will occur soon. The other task is to locate the W1AW AMTEX firmware to put into the TNC2. That doesn't exist right now, to my knowledge. I propose to egin writing that software soon after W1AW begins transmitting the necessary headers. If someone else would like to tackle the job let me know. I can set you up with some AMTOR FEC decode firmware as well as a Z80 monitor, both for the TNC2. I hope that by summer the BI system will be available to any amateur that wants to establish such a system.

**WRAP UP**

Well, the AMTEX concept is pretty simple and straight forward. However, that doesn't mean it isn't effective. It is certainly a success in the marine industry and probably will become one as well in the amateur bands. I don't know what topic I will take on in the next issue. Let me know if there's something special you want to see discussed.

*NOTES*

*(1) CCIR Recommendation 5402 (1986), NAVTEX*
*(2) Hersey, Joseph, "Making Marine Safety Messages Safer", Sea Technology, May 1986, pp. 16-18.*
*(3) Burhans Electronics, 161 Grosvenor Street, Athens, OH 45701*

## New PK-232 Firmware Released...

Advanced Electronic Applications, Inc. (AEA) recently released new firmware for their PK-232 multimode data controller. The changes contained in the 30-DEC-88 firmware release are as follows.

**New WHYNOT Command -** At times, packets will be received, but not displayed on the screen. When set ON, the WHYNOT function posts a message on your screen explaining why the packets were not displayed.

**New DIDDLE Command -** In Baudot and ASCII transmit modes, when DIDDLE is set ON and the user is not typing characters at the terminal keyboard, the PK-232 sends a continual stream of LTRS characters in Baudot and NULL characters in ASCII. This keeps the radio channel active, aids in maintaining character synchronization and facilitates tuning for the distant station.

**New AUDELAY Command -** The AUDELAY command permits the user to set a controlled delay between the transmitter PTT key-up and the start of the AFSK audio. Insertion of appropriate values of AUDELAY may help prevent arcing of amplifier relay contacts and reduce certain types of spurious emissions in synthesized radios.

**Simplified KISS Command -** When set ON, the KISS command now sets all packet-radio parameters needed for TCP/IP operation with the KA9Q NET implementations.

**New "Packet Dump" Suppression -** When an established packet-radio link fails or is suddenly disconnected, all data remaining in the PK-232's transmit buffer is discarded instead of being sent out on the radio channel as UI frames. The PK-232 clears the transmit buffer and issues a disconnect to the radio channel. However, normal operation of UI frames for beacons and "Mail for" transmissions from PBBSs is not affected. This is particularly useful to SYSOP's of PBBS and message switches.

**New CUSTOM Command -** The CUSTOM command allows limited customizing of the PK-232 for specific applications such as PBBSs and special host systems.

**New MWEIGHT Command -** The MWEIGHT command permits the user to vary the Morse code dot-to-space ratio from the default weight of 1:1.

**New Morse Code Word-wrap -** In Morse code receive, incoming word groups are broken at word boundaries depending on the setting of ACRDISP. This is similar to the word-wrap function in RTTY, AMTOR and packet-radio modes.

**New NUMS Command -** The NUMS command forces the PK-232 into the FIGS case in AMTOR and Baudot receive.

**New MID Command -** While in the packet-radio mode, the PK-232 now sends a station identification in Morse code at programmable time intervals to satisfy recent rules changes in the United Kingdom. (Morse code identification is no longer required in areas under FCC jurisdiction and it is suggested that American amateurs leave MID set to zero.)

**Improved MYCALL Operation -** Unless the user installs a valid call sign and MYCALL is left at the default value of "PK-232," the PK-232 will not transmit packets of any kind under any conditions.

**WRU Locked in AMTOR -** The WRU function is now locked ON in AMTOR. This simplifies user operation and auto-login with certain types of AMTOR mailboxes. However, in Baudot and ASCII, WRU is normally selectable by the ON/OFF toggle command. In addition, the AAB value is now defaulted as an empty field.

**Enhanced MBX Command -** MBX has been enhanced to accept the argument of ALL. Only data fields in the I-frames and UI-frames are shown. Data from retried frames is shown each time such frames are monitored. The MFROM and MTO commands are active.

**MPROTO Default Change -** The MPROTO command is now defaulted to OFF to help newcomers avoid screen or terminal conflicts with binary characters sent by certain types of packet-radio nodes and switches.

**If DAYTIME has not been set -** pressing a (CTRL-T) will cause an (*) to be sent.

For more information, contact AEA, P.O. Box C-2160, Lynnwood, WA 98036, telephone (206) 775-7373.
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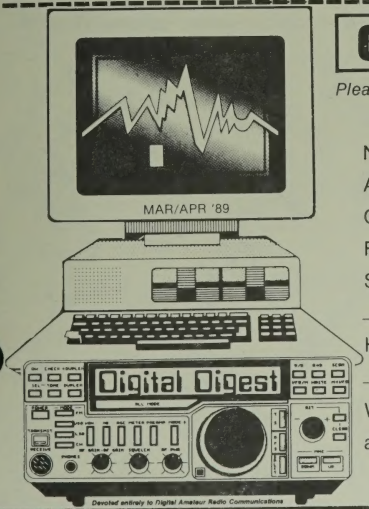


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